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Description

The present invention relates to a hydraulic door closer with a damper unit operatively connected to a spring which is not contained within the damper unit.

A conventional door closer comprises a piston biased towards an end of a cylinder by means of a return spring housed in the cylinder. Motion of the piston is fluid damped. The piston is moved to one side by a piston rod which is linked to the door and compresses the spring when the door opens. The piston is returned to its original position by the spring force of the compressed spring, and accordingly the door is closed.

US-A-4180888 shows a door closer comprising a damper unit having a piston which is movable within a cylinder and which carries a piston rod which projects from the cylinder and is operatively connected to a door so that opening and closing movement of the door is accompanied by movement of the piston in the cylinder, a spring actuating in the axial direction of the piston rod (7) being provided for biasing the piston in one direction, the spring being situated externally of the cylinder.

US-A-3137888 shows a similar door closer having a pivotal connection between piston rod and spring support element with only one degree of freedom, in which the spring is situated externally of the damping cylinder. This arrangement enables the cylinder to be made smaller since it does not have to house the spring. The volume of the cylinder can therefore be minimized, as can the volume of damping fluid it contains. Since commercially available damping fluid is usually flammable, such an arrangement consequently presents a reduced fire hazard.

As illustrated in Figure 3, in a conventional door closer, the contacting portion (b) of the terminal turn of the spring receives the force from the piston inner face. As shown in Figure 4, when a force is transferred to the contacting portion (b) of a circular cross-section spring (a), the section of the contacting end portion of spring pushed by the inside face of the piston becomes gradually thinner toward the end of the spring, and therefore the thicker section area receives more force than the thinner section portion, that is to say, the section portion through line A-A of contacting portion (b) received the most force, and accordingly the spring force is applied in a non-horizontal manner on the piston. Thus, during extended use, a certain degree of friction occurs between the inside surface of the cylinder and an outer region of the outside wall of the piston causing wear, eventual leak, vibration of the piston and plugging of a communicating hole by eroded fragments. This damage eventually leads to faulty operation of the conventional door closer.

According to the present invention this problem is solved by mounting a spring support element between the spring and the piston rod for transmitting force therebetween, the spring support element being provided with a central depression receiving the end of the piston rod away from the cylinder to permit relative pivotal movement between the piston rod and the spring support element.

Thus, the piston connected to the piston rod operates without any tilting motion and therefore actuation is accurate and remains accurate during extended use. Also any wear between cylinder and piston is eliminated, such that no harmful fragments are formed to plug the communicating holes of the damping mechanism.

For a better understanding of the present invention and to show how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is an exploded view of the present device;

Figures 2A through 2F are sectional views illustrating operation of the present device;

Figure 3 is a perspective view of a conventional spring; and

Figures 4A, 4B, 4C are sectional views through lines A-A, B-B, C-C respectively of Figure 3 of the present device.

Referring to Figure 1, a piston (9) is fixed on a piston rod (7) by a bolt (24) and is slideably supported in a fluid filled cylinder (3)(3'). A plug (12) is screwed onto one end of the cylinder (3) and provides a fluid tight seal. In order to provide communication between both sides of cylinder (3)(3'), separated by piston (9), a communicating hole (11) is provided in one side of piston (9). A check valve (10) is installed in communicating hole (11). Also on the upper side of the piston rod (7), a rack gear (8) is provided in order to engage with pinion (16) which is fixed to a pinion shaft (17). A flow path (4) is provided along cylinder (3') in order to provide fluid communication between through hole (5) and through holes (5')(5") which are provided in one side of flow path (4) and are able to be opened and closed by regulating bolts (6)(6'). At the other side of the main body (1') a spring operating chamber (13) is installed, the spring being supported in the chamber (13) by a spring support plate (15). The spring support element (15) and the end of the piston rod (7) are provided with cooperating curved surfaces to permit pivotal movement of the support element (15) relatively to the piston rod (7). A plug (12') is screwed on the other end of chamber (13).

Concave notches (2) are provided on each side of main body (1) in order for the convex ridges (19) of a cover (18) to be engaged. Reference numbers (20)(22) indicate through holes which are not described in detail. Reference numerals (23)(23')(23") indicate washers.

In the present device, the piston (9) reciprocates by the operation of piston rod (7) and the spring (14). When the door opens, the pinion (16) is rotated by the

rotation of pinion shaft (17) and the piston rod (7) and the piston (9) are moved in the same direction to one end of the cylinder (3)(3') due to the engagement of the rack gear (8) of the piston rod (7) with the pinion (16). When the door is closed, the piston rod (7) is returned to its original position by the expanding force of spring (14) and the piston (9) is also returned.

When the door opens, pinion (16) is rotated by pinion shaft (17) which moves the rack gear (8) of the piston rod (7) to the other side as shown in Figure 2B. Then, the piston (9) installed on the piston rod (7) inside of cylinder (3)(3') is moved within cylinder (3') and the oil flows simultaneously to cylinder (3) through check valve (10) in communicating hole (11) one side of piston (9) and through flow path (4). Here, when the door begins to be opened, the oil flows only through check valve (10) of communicating hole (11) and the amount of flow becomes progressively reduced. Therefore the piston receives resistance in the course of moving within cylinder (3') and some force is required initially to open the door, and as further opening proceeds, the movement of piston (9) proceeds further, and through holes (5')(5") open successively causing larger amounts of oil to flow, so that less force is needed to open the door wider.

Thus, by the opening action of the door, the other end of piston rod (7) pushes the spring support plate (15) supported by spring (14) in the spring operating chamber causing compression of spring (14). As a consequence, when the door is left open, the spring support plate (15) is returned to its original position by the force of spring (14) and the piston rod (7) is returned to cylinder (3).

As shown in Figure 2D, at the moment of moving of piston (9) toward cylinder (3), check valve (10) becomes closed by oil, and the oil of cylinder (3') passes through flow path (4) via the through holes (5')(5"). Thus, when the piston (9), which moves continuously to cylinder (3) by the force of spring (14), is at a position 70 to 75 degrees before closing of the door, that is, from the moment of closing the through hole (5"), the oil flows to cylinder (3') only via the through hole (5'), and therefore the flow speed of oil becomes slow, and also resistance occurs by the oil causing slow speed of piston movement, and the pinion shaft (17) rotates slowly as the actuating rod (7) moves slowly, and finally the door closes slowly for the final 15 to 20 degrees of movement before full closing of the door.

The regulating bolts (6)(6') screwed above the through hoes (5')(5") in flow path (4) regulate the amount of oil flowing in accordance with the degree of opening and closing of the through holes (5')(5"), and they also regulate the moving speed of piston (9) so that the closing speed of the door can be regulated.

By means of separately installing cylinders (3)(3') with an operating piston (9), and the spring operating chamber (13) actuating the piston rod (7), and also by transferring to the piston rod (7) the force exerted from piston (9) when the door opens and the force exerted from spring (14) when the door closes and also by concentrating the force transferred to the actuating rod (7) on the central portion of piston (9) operating inside of cylinder (3)(3'), the operational accuracy of piston (9) can be maintained for a long time. Also little or no wear occurs between cylinder (3)(3') and piston (9), and no fragments are formed so that through holes (5)(5')(5") are never clogged. And by separating the spring operating chamber (13), so making cylinder (3)(3') small, and accordingly by lessening the amount of oil, any possible fire hazards are diminished. The cover (18) over the main body (1) is provided only to enhance the appearance of the door closer.

Claims

1. A door closer comprising a damper unit having a piston (9) which is movable within a cylinder (3,3') and which carries a piston rod (7) which projects from the cylinder (3,3') and is operatively connected to a door so that opening and closing movement of the door is accompanied by movement of the piston (9) in teh cylinder (3,3'), a spring (14) actuating in the axial direction of the piston rod (7) being provided for biasing the piston (9) in one direction, the spring (14) being situated externally of the cylinder (3,3'), characterized in that a spring support element (15) is mounted between the spring (14) and the piston rod (7) for transmitting force therebetween, the spring support element (15) being provided with a central depression receiving the end of the piston rod (7) away from the cylinder (3,3') to permit relative pivotal movement between the piston rod (7) and the support element (15).

2. A door closer as claimed in claim 1, characterized in that the cylinder (3,3') is formed in a main body (1) of the door closer, the spring (14) being accommodated in a separate housing (13) formed integrally with the main body (1).

3. A door closer as claimed in any one of the preceding claims, characterized in that the piston rod (7) is additionally supported at a position away from the piston (9).

4. A door closer as claimed in any one of the preceding claims, characterized in that the piston rod (7) is provided with a rack gear (8) which engages a pinion (16) operatively connected to the door.

5. A door closer as claimed in any one of the preced-

ing claims, characterized in that there is further provided valve means (5,5'; 6,6'; 10) for bypassing fluid past the piston (9) to regulate its motion, the valve means (5,5'; 6,6'; 10) being located within the cylinder (3,3').

6. A door closer as claimed in claim 5, characterized in that the valve means (5,5'; 6,6'; 10) comprises a check valve (10) mounted in the piston (9) for bypassing fluid past the piston (9) in one direction.

7. A door closer as claimed in claim 5 or 6, characterized in that the valve means comprises a conduit (4) in said body for communicating with a plurality of axially spaced orifices (5,5',5") in the cylinder (3,3').

8. A door closer as claimed in claim 7, characterized in that at least one of the axially spaced orifices (5,5',5") includes an orifice valve means (6,6') for regulating the flow of fluid through the orifice (5,5',5").

9. A door closer as claimed in any one of claims 5 to 8, characterized in that at least one of the orifices is positioned such that it is closed by the piston (9) during part of the stroke of the piston (9) in the cylinder (3,3').

10. A door closer as claimed in any one of the preceding claims, characterized in that the door closer is provided with a cover attached to the body by a tongue and groove joint.

Patentansprüche

1. Türschließer mit einer Dämpfungseinheit, die einen Kolben (9) aufweist, der innerhalb eines Zylinders (3,3') bewegbar ist und der eine Kolbenstange (7) trägt, die sich vom Zylinder (3,3') aus erstreckt und die mit einer Tür wirksam verbunden ist, so daß eine Öffnungs- und Schließbewegung der Tür mit einer Bewegung des Kolbens (9) im Zylinder (3,3') verbunden ist, einer Feder (14), die in der axialen Richtung der Kolbenstange (7) antreibbar ist, die vorgesehen ist, um den Kolben (9) in einer Richtung vorzuspannen, wobei die Feder (14) außerhalb des Zylinders (3,3') angeordnet ist,
dadurch gekennzeichnet,
daß ein Federhalteelement (15) zwischen der Feder (14) und der Kolbenstange (7) montiert ist, um zwischen ihnen eine Kraft zu übertragen, wobei das Federhalteelement (15) mit einer zentralen Vertiefung versehen ist, die das Ende der Kolbenstange (7) fern vom Zylinder (3,3') aufnimmt, um eine relative Drehbewegung zwischen dem Kolben (7) und dem Halteelement (15) zuzulassen.

2. Türschließer nach Anspruch 1, dadurch gekennzeichnet, daß der Zylinder (3,3') im Hauptkörper (1) des Türschließers gebildet ist, und daß die Feder (14) in einem separaten Gehäuse (1) untergebracht ist, das einstückig mit dem Hauptkörper (1) ausgebildet ist.

3. Türschließer nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Kolbenstange (7) zusätzlich an einer Position fern vom Kolben (9) gelagert ist.

4. Türschließer nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Kolbenstange (7) mit einer Zahnstange (8) versehen ist, die in ein Ritzel (16) eingreift, das mit der Tür wirksam verbunden ist.

5. Türschließer nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß weiter eine Ventileinrichtung (5,5'; 6,6', 10) vorgesehen ist, um ein Fluid am Kolben (9) vorbei in einem Bypaß vorbeizuleiten, um seine Bewegung zu regulieren, wobei die Ventileinrichtung (5,5'; 6,6'; 10) innerhalb des Zylinders (3,3') angeordnet ist.

6. Türschließer nach Anspruch 5, dadurch gekennzeichnet, daß die Ventileinrichtung (5,5'; 6,6'; 10) ein Rückschlagventil (10) aufweist, das im Kolben (9) montiert ist, um ein Fluid am Kolben (9) vorbei in einer Richtung vorbeizuleiten.

7. Türschließer nach Anspruch 5 oder 6, dadurch gekennzeichnet, daß die Ventileinrichtung im Körper einen Kanal (4) aufweist, der mit mehreren axial voneinander beabstandeten Öffnungen (5,5'; 5") im Zylinder (3,3') in Verbindung steht.

8. Türschließer nach Anspruch 7, dadurch gekennzeichnet, daß zumindest eine der axial voneinander beabstandeten Öffnungen (5,5', 5") eine Öffnungsventileinrichtung (6,6') aufweist, um den Fluidstrom durch die Öffnung (5,5'; 5") zu regulieren.

9. Türschließer nach einem oder mehreren der Ansprüche 5 bis 8, dadurch gekennzeichnet, daß zumindest eine der Öffnungen so angeordnet ist, daß sie durch den Kolben (9) während eines Teils des Hubs des Kolbens (9) im Zylinder (3,3') geschlossen ist.

10. Türschließer nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der

Türschließer mit einer Abdeckung versehen ist, der mit dem Körper mittels einer Rastverbindung verbunden ist.

Revendications

1. Ferme-porte comprenant un ensemble amortisseur, comprenant un piston (9) déplaçable dans un cylindre (3, 3') et portant une tige de piston (7) faisant saillie hors du cylindre (3, 3') et relié fonctionnellement à une porte, de manière que le mouvement d'ouverture et de fermeture de la porte soit accompagné d'un mouvement du piston (9) dans le cylindre (3, 3'), un ressort (14) agissant dans la direction axiale de la tige de piston (7) étant prévu pour déplacer le piston (9) dans un direction, le ressort (14) étant situé à l'extérieur du cylindre (3, 3'), caractérisé en ce qu'un élément support de ressort (15) est monté entre le ressort (14) et la tige de piston (7), en vue de transmettre une force entre eux, l'élément support de ressort (15) étant pourvu d'un enfoncement central, recevant l'extrémité de la tige de piston (7) éloignée du cylindre (3, 3'), afin de permettre un mouvement de rotation relative entre la tige de piston (7) et l'élément support (15).

2. Ferme-porte selon la revendication 1, caractérisé en ce que le cylindre (3, 3') est formé dans un corps principal (1) du ferme-porte, le ressort (14) étant logé dans un boîtier (13) séparé, formé d'un seul tenant avec le corps principal (1).

3. Ferme-porte selon l'une quelconque des revendications précédentes, caractérisé en ce que la tige de piston (7) est en plus supportée en une position éloignée du piston (9).

4. Ferme-porte selon l'une quelconque des revendications précédentes, caractérisé en ce que la tige de piston (7) est pourvue d'une crémaillère (8) s'engageant avec un pignon (16) relié fonctionnellement à la porte.

5. Ferme-porte selon l'une quelconque des revendications précédentes, caractérisé en ce que sont en outre prévus des moyens de soupape (5, 5'; 6, 6'; 10), pour dériver du fluide au-delà du piston (9), en vue de régler son mouvement, les moyen de soupapes (5, 5'; 6, 6'; 10) étant situés à l'intérieur du cylindre (3, 3').

6. Ferme-porte selon la revendication 5, caractérisé en ce que les moyens de soupape (5, 5'; 6, 6'; 10) comprennent un clapet (10) monté dans le piston (9), en vue de dériver du fluide au-delà du piston (9), dans une direction.

7. Ferme-porte selon la revendication 5 ou 6, caractérisé en ce que les moyens de soupape comprennent un conduit (4), ménagé dans ledit corps, pour assurer une communication avec une pluralité d'orifices (5, 5', 5") espacés axialement dans le cylindre (3, 3').

8. Ferme-porte selon la revendication 7, caractérisé en ce qu'au moins l'un des orifices (5, 5', 5") espacés axialement comprend un moyen de soupape à orifice (6, 6'), pour régler le débit du fluide passant à travers l'orifice (5, 5', 5").

9. Ferme-porte selon l'une quelconque des revendications précédentes, caractérisé en ce qu'au moins l'un des orifices est positionné de telle façon qu'il soit fermé par le piston (9) pendant une partie de la course du piston (9) dans le cylindre (3, 3').

10. Ferme-porte selon l'une quelconque des revendications précédentes, caractérisé en ce que le ferme-porte est pourvu d'un couvercle fixé au corps par un assemblage à fausse languette.

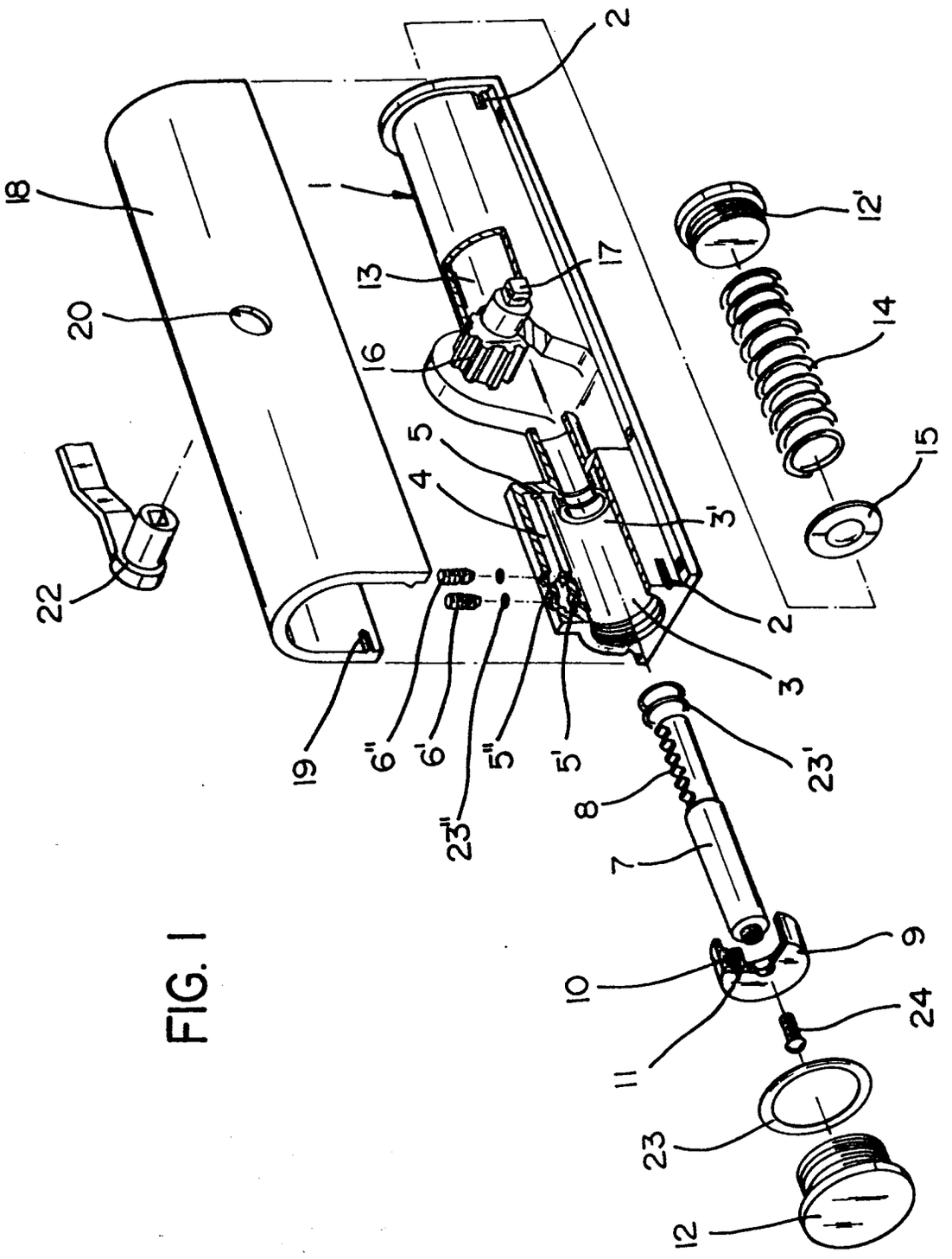

FIG. 1

FIG.2A

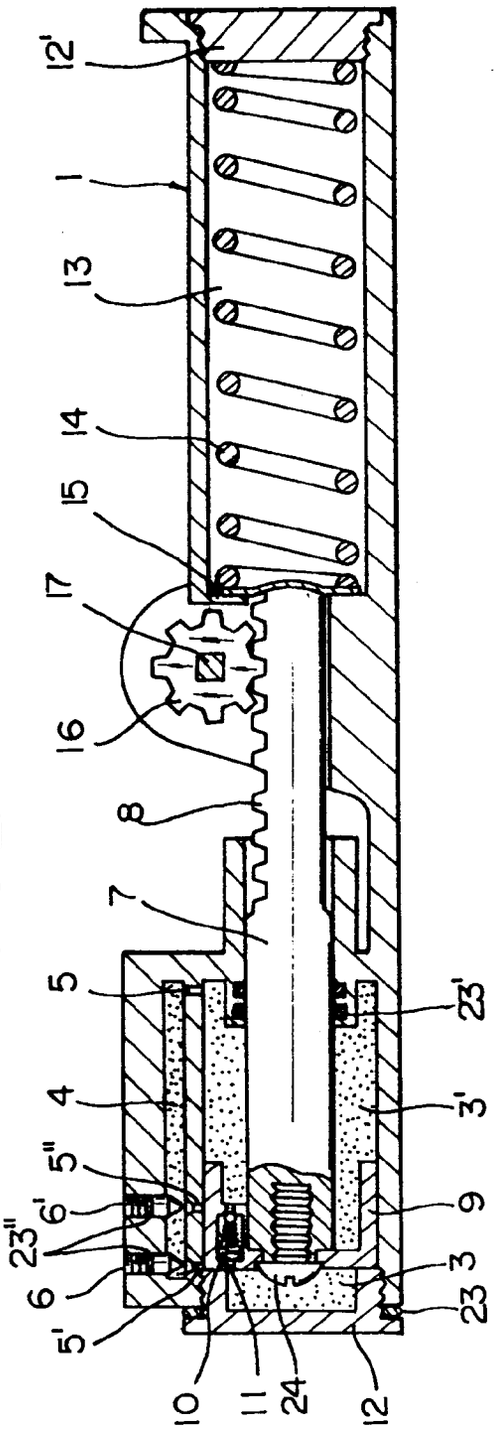
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FIG.2B

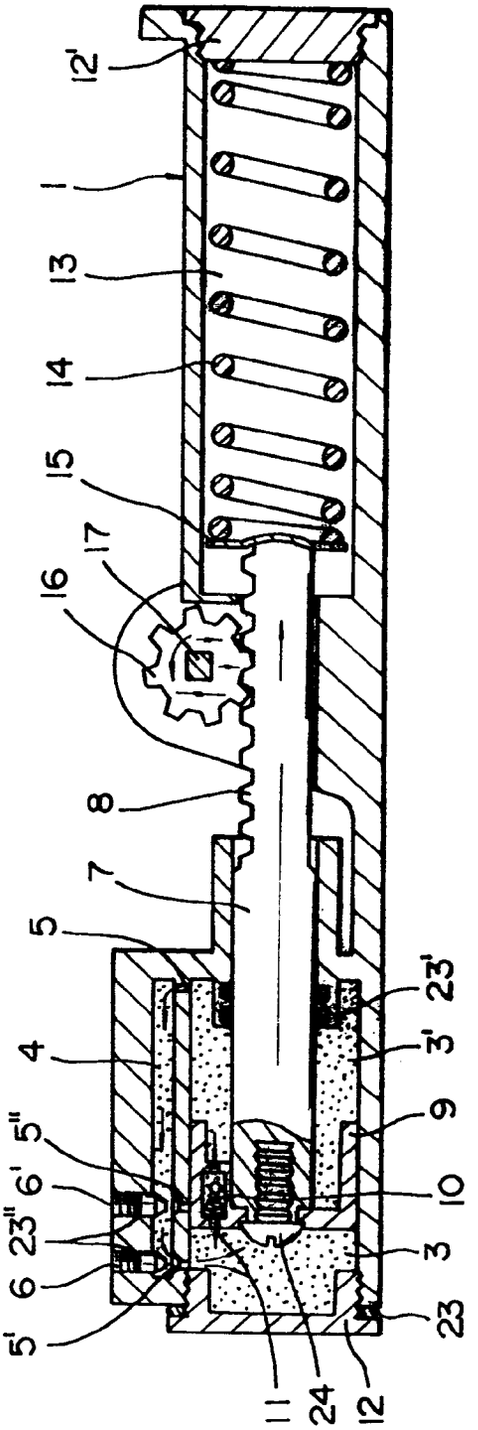
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FIG. 2C

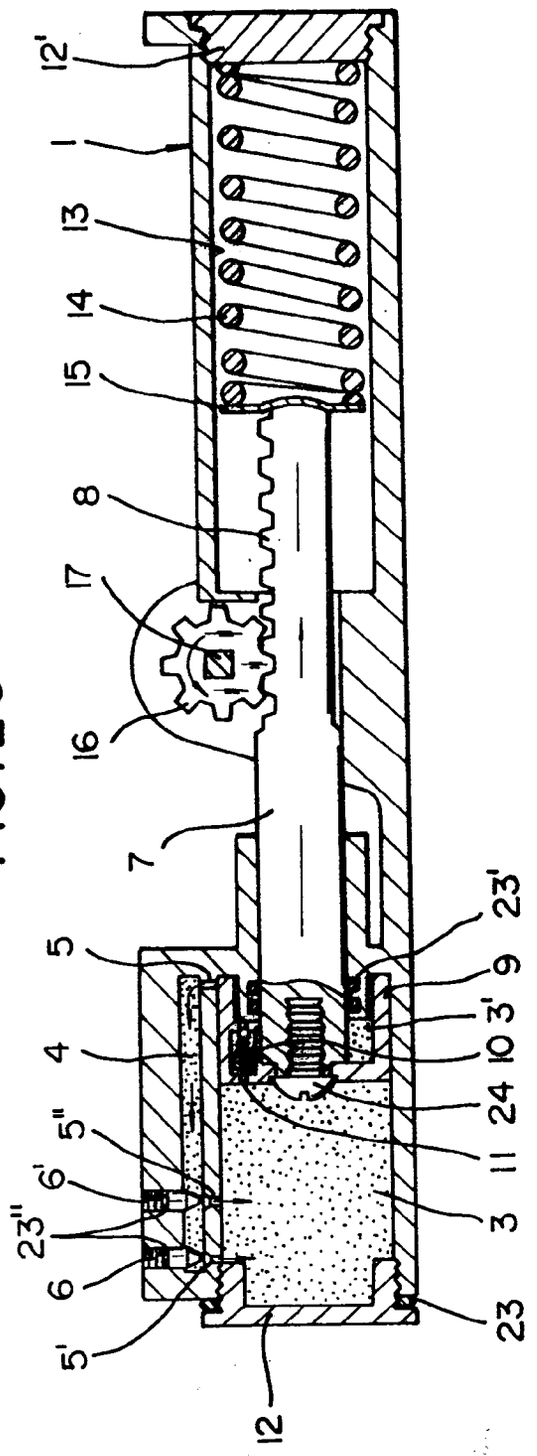
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FIG. 2D

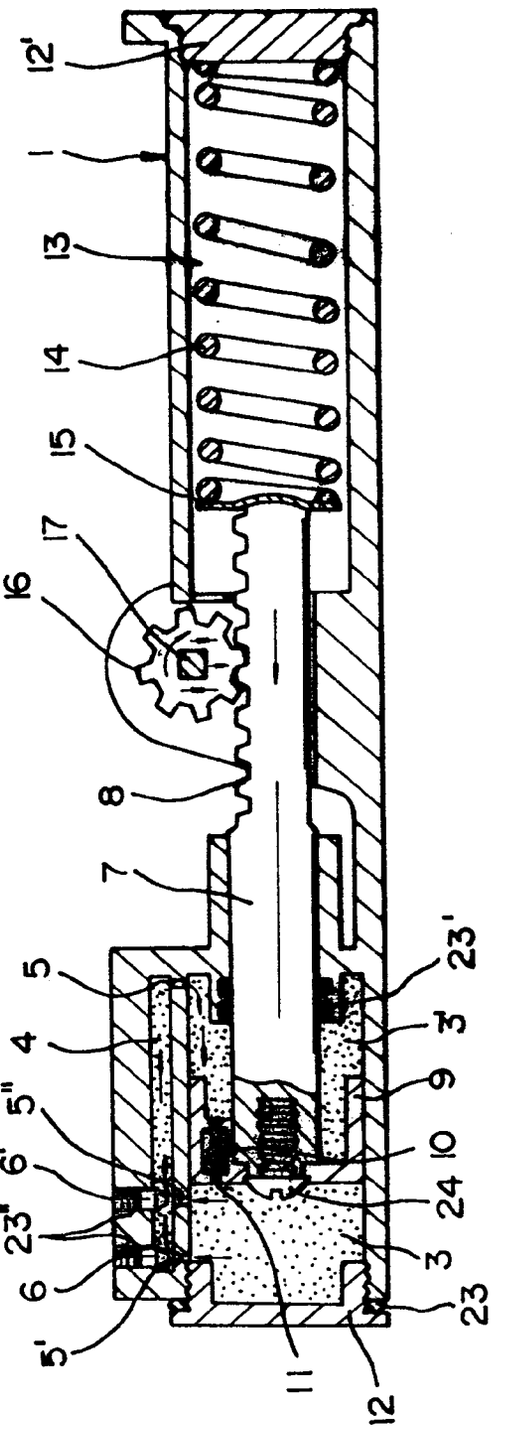
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FIG.2E

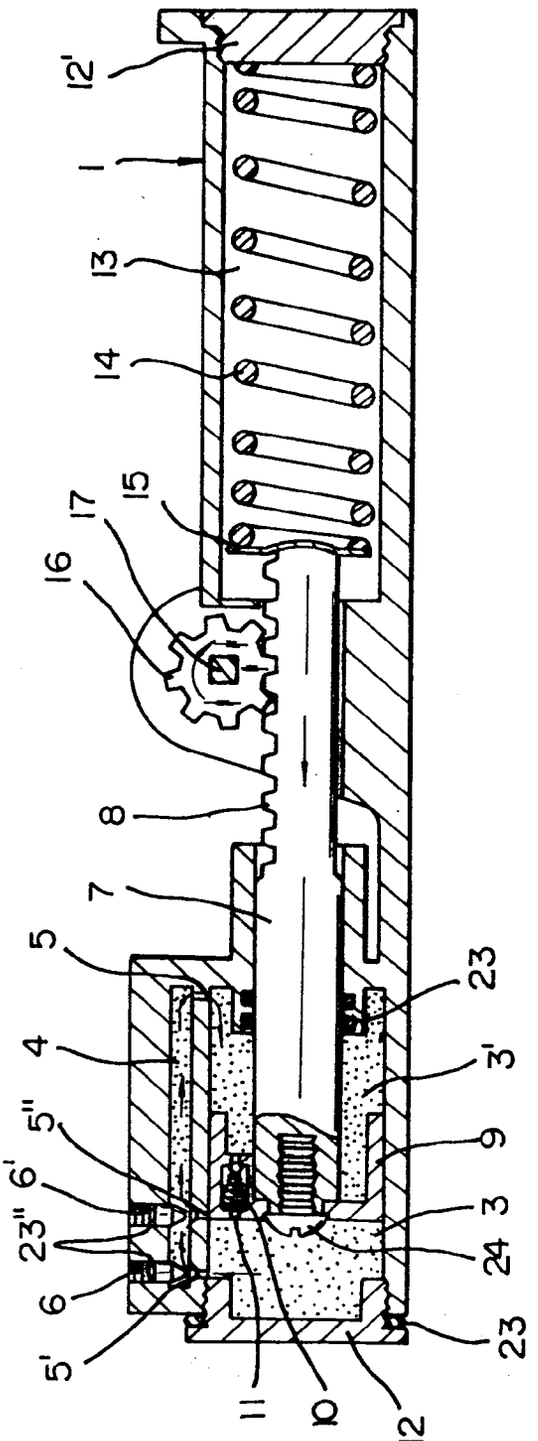
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FIG.2F

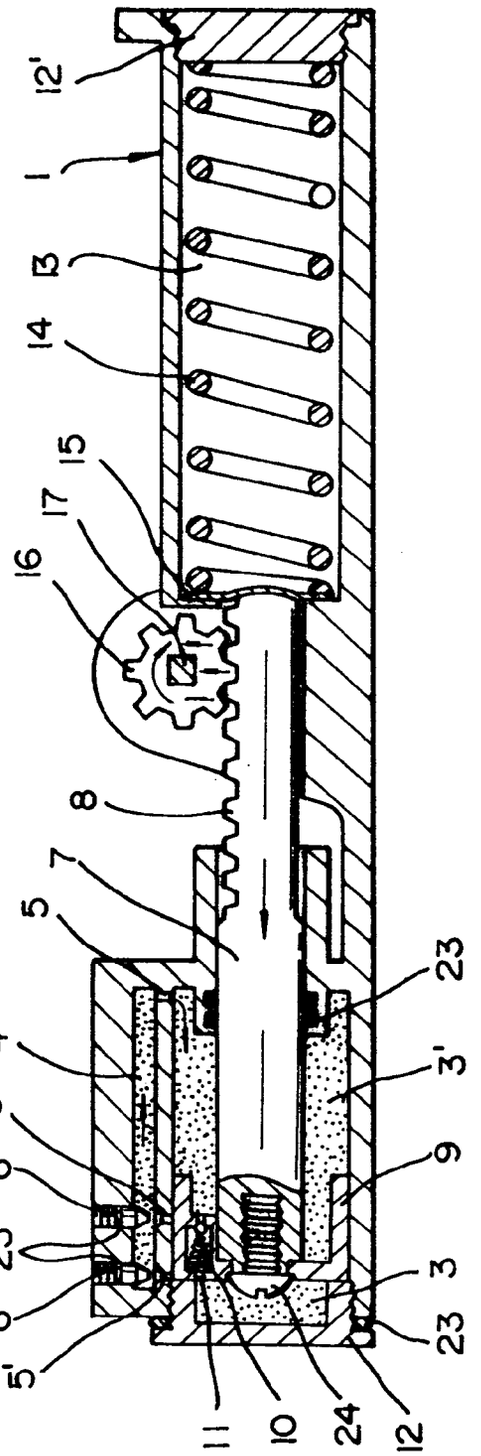
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FIG.4

FIG.3